

PES Benzene Fence Line Monitoring:

prepared by JKelly 2/3/20

Background: After reading the article in the link below, and hearing discussions at the 1/23/20 Philadelphia Air Pollution Control Board meeting, I decided to review PES's benzene fence line data to determine if there was a potential health concern in the nearby residential community. ATSDR Region 3 also had an interest in reviewing the fence line results and ATSDR's Bob Helverson provided much needed support to me in organizing and displaying the data.

[HYPERLINK

"https://gcc01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.eenews.net%2Fstories%2F1062097771&data=02%7C01%7Cbrussell%40pa.gov%7Ce5057c720ae74adbeef308d7a363a9e7%7C418e284101284dd59b6c47fc5a9a1bde%7C0%7C0%7C637157521507670946&sdata=fkAOxZVcbDkkv4GcA%2FfNs55t5jVtSNSdluUitobRRX8%3D&reserved=0"]

See the attached DRAFT figure and tables prepared by Bob Helverson. The data is presented for what we believe was made available by PES; that is, passive benzene data collected in two week increments from January 2018 through September 2019. You will see that the highest observed benzene values are found at stations generally removed from nearby residential areas on the west side of the plant. (Bob plans to QA the data a bit more thus the figure and tables are marked draft.)

Also see attached a general evaluation of the data via email from PES's Environmental Manager Chuck Barksdale and an email pdf I prepared providing additional information on short-term upsets/incidents he mentions, including dates. The incidents appear to have contributed to elevated benzene results in nearby passive monitors.

The table below identifies various risk-based air concentrations in ug/m3 for benzene. Although a cursory literature search reveals that more recent urban air studies focusing on benzene have taken place overseas, earlier data from the 1980s and 1990s would suggest that urban outdoor air benzene values are *generally* in the single digit ug/m3 range but certainly can be higher if near specific sources. Indoor air values can be elevated due to smoking and other indoor sources. See the references below.

Point: I wanted to review the fence line data to see if air sampling for benzene in the nearby residential areas might be warranted. Based on this preliminary review, it does not appear necessary.

EPA RSL 1E-6 cancer	EPA RSL Non cancer HI =1	EPA RML 1E-4 cancer	EPA RML Non- cancer HI =3	ATSDR Intermediate MRL	ATSDR Chronic MRL	EPA RfC	EPA* refinery benzene action level	NIOSH occupational REL
0.36	31.0	36.0	94.0	18.0	9.0	30	9.0	300

Values in ug/m3 1 ppb benzene = 3.2 ug/m3 so, 9 ug/m3 = ~ 3ppb

RSLs are chemical-specific concentrations for individual contaminants in air, drinking water and soil that may warrant further investigation or site cleanup. They are used to assist OSCs, RPMs, risk assessors and other Superfund personnel to determine whether levels of contamination found at the site may warrant further investigation or site cleanup, or whether no further investigation or action may be required. The generic RSL table corresponds to risk levels of approximately 10-6 and/or an HQ of 1 for long-term exposure to individual chemicals at a site.

RMLs assist On Scene Coordinators (OSCs) and others involved in decision-making concerning at Superfund sites. The RMLs are chemical-specific concentrations for individual contaminants in tap water, air, and soil that may be used to support the decision for EPA to undertake a removal action. Although they are not necessarily health protective concentrations for chronic exposure, exceedance of an RML by itself does not imply that adverse health effects will occur. Calculated RMLs are not meant to define protective levels and are not de facto cleanup levels. Thus, generic RMLs correspond to risk levels of approximately 10^{-4} and/or a Hazard Quotient of up to 3 for long-term exposure to **individual** chemicals at a site. A 10^{-4} risk level corresponds to the upper-end of EPA's generally acceptable risk range of 10^{-4} to 10^{-6} as discussed in the National Contingency Plan (NCP), 40 CFR 300.430. The NCP gives no analogous recommended range for non-carcinogenic risks.

An **ATSDR MRL** is an estimate of the daily human exposure to a hazardous substance that is likely to be MRLs are derived for acute (1-14 days), **intermediate (>14-364 days)**, and **chronic (365 days and longer)** exposure durations without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. MRLs are intended to serve as a screening tool to help public health professionals decide where to look more closely.

EPA Reference Concentration (RfC): An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark concentration, with uncertainty factors generally applied to reflect limitations of the data used.

NIOSH REL: The REL is a level that NIOSH believes would be protective of workplace safety and employee health over a working lifetime.

EPA refinery benzene action level (From EPA Spreadsheet Fenceline Monitoring Template): EPA established the benzene action level by conducting atmospheric dispersion modeling to determine expected fence line benzene concentrations. The dispersion modeling used the emissions inventories reported by refineries in response to the 2011 Refinery ICR, which were adjusted to represent reductions from additional control requirements prescribed in amendments to Refinery MACT CC and 40 CFR part 63 subpart UUU (together, the Refinery Sector MACT Rules) that were published on Dec. 1, 2015. Modeling was conducted using EPA's American Meteorological Society/EPA Regulatory Model dispersion modeling system (AERMOD) to determine estimated concentrations within the sites and extending from the facility outward to a distance of 50 kilometers. This modeling indicated that based on refinery emissions sources controlled consistent with the existing and updated provisions specified in the Refinery Sector MACT Rules, the maximum post-control benzene concentration expected at the fenceline should be $9 \mu\text{g}/\text{m}^3$ (annual average).

The refinery emissions inventories generally reflect the emissions from emission sources with required emissions controls working as designed (e.g., no tears in seals for storage vessel floating roofs, water seals in sewer drains). If a refinery's emissions inventory is correct, then the annual average Δc benzene values for the refinery should not exceed $9 \mu\text{g}/\text{m}^3$. Because EPA's modeling approach considers only the emissions from the refinery and not the background readings from emission sources external to the refinery, this concentration is comparable to the highest modeled fenceline concentration after correcting for these background emission sources. The subtraction of the lowest monitor reading from the highest monitor reading in the calculation of Δc accounts for background readings from these emissions sources.

REFERENCES:

- Wan-Kuen Jo & Jee-Won Oh (2001) Exposure to Methyl Tertiary Butyl Ether and Benzene in Close Proximity to Service Stations, Journal of the Air & Waste Management Association, 51:8, 1122-1128, DOI: 10.1080/10473289.2001.10464339
- Haofei Yu, Amy L. Stuart, Exposure and inequality for select urban air pollutants in the Tampa Bay area, Science of the Total Environment 551–552 (2016) 474–483
- [HYPERLINK "<https://cfpub.epa.gov/roe/documents/BenzeneConcentrations.pdf>"]
- [HYPERLINK "http://www.euro.who.int/__data/assets/pdf_file/0017/123056/AQG2ndEd_5_2benzene.pdf"] (interesting information but dated – year 2000)
- ATSDR, Benzene Toxicological Profile, 2007 (specifically Section 6 and Appendices) [HYPERLINK "<https://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=40&tid=14>" \l "bookmark01"]
- NIOSH Pocket Guide for Benzene [HYPERLINK "<https://www.cdc.gov/niosh/npg/npgd0049.html>"]
- EPA IRIS Database for Benzene [HYPERLINK "https://cfpub.epa.gov/ncea/iris2/chemicallanding.cfm?substance_nmbr=276"]
- FINAL Guidance for Evaluating Soil Vapor Intrusion in State of New York October 2006 (see Appendix C)
- New York State Department of Health Study of Volatile Organic Chemicals in Air of Fuel Oil Heated Homes [HYPERLINK "https://www.health.ny.gov/environmental/indoors/air/docs/fuel_oil.pdf"]
- Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1990–2005): A Compilation of Statistics for Assessing Vapor Intrusion Office of Solid Waste and Emergency Response U.S. Environmental Protection Agency Washington, DC, EPA 530-R-10-001, June 2011.